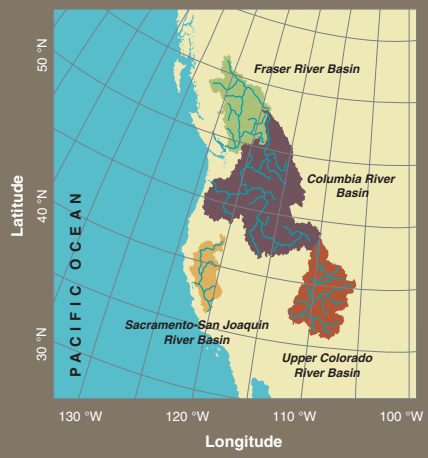
edited by Gilbert Chin

EARTH SCIENCE

Forecast: Rain, Less and More

One of the most important aspects of global climate is precipitation, and variations in its timing or amount can have an enormous impact on human resources and activities. A pair of papers illustrate two different aspects of this type of variability. El Niño and La Niña events have dramatic effects on patterns of precipitation all across the globe and are often cited as the cause of large economic losses, because these events are associated with extremes of weather. However, Goddard and Dilley find that climate anomalies during these events are not greater than those that occur in the intervening periods. Moreover, because climate forecasts during El Niño and La Niña events are more accurate than those in the intervening periods, greater preparedness should actually lead to a diminished economic impact.

Jain *et al.* focus on regional hydrologic change in western North America during the late 20th century. They find a trend toward increasing year-to-year variance of stream flow in the major river basins, which coincides with an increase in the synchrony of stream flow changes across basins. These trends are closely related to the atmospheric circulation regimes of the late 20th century. They discuss the implications of this regional hydrologic change on the vulnerability of water resources and raise concerns about the adequacy of water resource planning and operations in this region. — HJS



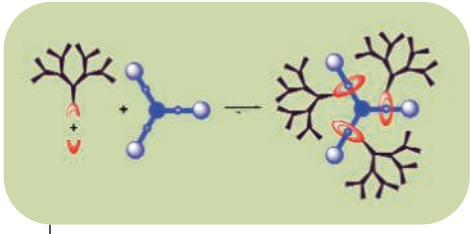
Western North America river basins.

J. Clim. **18**, 651; 613 (2005).

CHEMISTRY

Flexible Dendrimer Synthesis

The formation of dendrimers, in which branching polymer chains extend from a central core, normally involves the covalent attachment of the dendrons to a central core. Leung *et al.* report a dynamic covalent chemistry strategy for the mechanical attachment of dendrons to a core; this pathway, unlike earlier forays, proceeds in high yield. The core bears $-CH_2NH_2^+CH_2-$ centers on each arm that act as binding sites for crown ether groups terminated with two primary amines. These amines are then bridged by a dialdehyde-bearing dendron, producing two imine linkages and forming the ring that locks the macrocycle-dendrimer onto the core. These kinetically stable dendrimers form in >90% yields and can be fixed in place by reduction of the C=N bonds with BH_3 in tetrahydrofuran and subsequent deprotonation with aqueous NaOH. The formation of each generation (0, 1, and 2) of dendrimer products, which reach molecular weights of up to ~5000, was verified by mass spectrometry. — PDS



A representation of the synthesis process and the generation 1 dendrimer.

J. Am. Chem. Soc. 10.1021/ja0501363.

PLANT BIOLOGY

Closing the Wound

In the normal cut and thrust of everyday life, nonfatal injuries are common, and organisms rely on rapid repair mechanisms to stanch the loss of fluids. Adolph *et al.* have studied the invasive tropical green alga *Caulerpa taxifolia*, which lives as single polyploid multinucleated cells. In the early 1980s, *Caulerpa* invaded the Mediterranean, and its mechanism of wound repair may have contributed to its high growth rates. When the algal cells are mechanically broken, a gelatinous material consisting of cross-linked proteins rapidly plugs the wound and results in two cells, each with a full genomic inheritance. Polymer formation depends on the enzymatic unmasking of caulerpenyne, the dominant secondary metabolite of the alga. Its 1,4-bis-enoylacetate moiety is transformed into a dialdehyde, which reacts with nucleophilic groups of algal proteins, forming a life-saving plug. — SMH

Angew. Chem. Int. Ed. **44**, 10.1002/anie.200462276 (2005).

ECOLOGY/EVOLUTION

Too Much of a Good Thing

The widespread agricultural use of nitrogenous fertilizers in recent decades has doubled the amount of available nitrogen in the global ecosystem. Although higher levels of N generally cause an increase in primary productivity (the rate at which new plant growth is produced via photosynthesis), they also cause a loss of diversity.

To understand the mechanisms linking N supply to diversity, Suding *et al.* conducted a series of N fertilization experiments across a range of North American ecosystems and assessed the functional and ecological correlates of declining diversity in nearly 1000 plant species. One-third of species losses from the experimental plots were attributable to the initial rarity of these plant species. In most other cases, losses could be attributed to physiological or morphological traits of species. In particular, perennials and species with N-fixing symbioses (such as legumes) were more prone to local extinction after N fertilization, and native species tended to fare worse than non-natives. The relative importance of the trait-specific effects (versus initial abundance) varied across ecosystems; for example, there was a disproportionate loss of legumes from tallgrass

CREDITS: (TOP) JAIN *ET AL.*, *J. CLIM.* **18**, 651; 613 (2005).; (BOTTOM) LEUNG *ET AL.*, *J. AM. CHEM. SOC.* 10.1021/JA0501363

Published by AAAS

prairie. Thus, these experiments generate predictions of how patterns of plant diversity will decline as N loading continues to increase. — AMS

Proc. Natl. Acad. Sci. U.S.A. **102**, 4387 (2005).

CHEMISTRY

Stitching Siloxanes

Siloxane polymers are widely used for their rubbery character. The stiffness and durability of the materials are influenced by the side groups pendant from the main Si-O chain. However, polymerization conditions often restrict the structural versatility of the monomers.

Chauhan and Rathore use platinum nanoclusters as a hydrosilation catalyst to append terminal olefins to the Si-H branches of (methylhydro)siloxane polymers. The reaction proceeds in benzene at room temperature with 0.1% catalyst loading and shows remarkable functional group tolerance. In addition to aromatic and alkyl groups, olefins bearing carbonyls, epoxides, and ferrocene were all successfully incorporated. Analysis of the products by nuclear magnetic resonance spectroscopy revealed strong regioselection (99:1 for nonaromatics) for Si bonding to the terminal carbon. — JSY

J. Am. Chem. Soc. 10.1021/ja042824c (2005).

PSYCHOLOGY

Genes and Environment

A classic approach to assessing the relative contributions of genes and environment to human behavior is to interrogate identical and fraternal twins. Hughes *et al.* have recruited 1116 pairs of twins (56% of whom are identical) in England and Wales and measured their performance at 5 years of age on a battery of theory-of-mind tasks, which collectively probe an understanding that beliefs can be false representations of reality (see also Perner and Ruffman, Perspectives, 8 April, p. 214). They find that genetic factors account for very little of the variance in task performance, and that shared (for example, siblings and social-economic status) and nonshared environmental factors each explain about half of the variance. The nonshared influences may come either from within the home, in the form of contrasting parental care, or from without, via interactions with socially skilled peers. It will be of interest to revisit these children in order to explore the relation between their theory-of-mind skills and their social development. — GJC

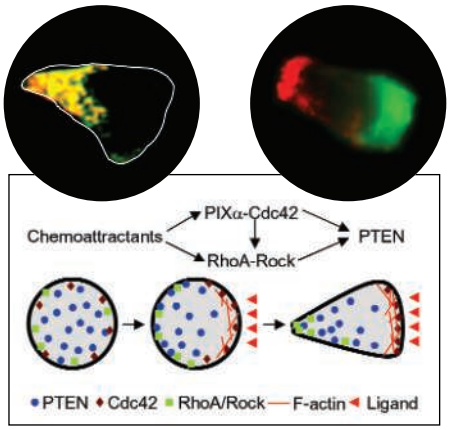
Child Dev. **76**, 356 (2005).

CELL BIOLOGY

Front and Back

Mammalian neutrophils and the amoebalike cells of the slime mold *Dictyostelium discoideum* respond to chemoattractants by engaging specific signaling mechanisms at the front and rear ends of the cell. During chemotaxis, two members of the Rho family of small GTPases, Rac and Cdc42, control actin dynamics at the leading edge of the cell. Meanwhile, RhoA controls contraction at the trailing end, which is where the phosphatase PTEN resides (which has the effect of restricting its phosphatidylinositol trisphosphate substrate to the front end).

Li *et al.* discovered that treatment of neutrophils or human embryonic kidney (HEK) cells with an inhibitor of RhoA-associated kinase (ROCK) blocked PTEN localization in response to a chemoattractant. Further analysis of HEK cells revealed that PTEN translocation and



A model for GTPase regulation of PTEN, and localizations of Rho (left, green), Cdc42 (right, green), and PTEN (red).

activation could be induced by a constitutively activated form of RhoA and also by active Cdc42. A mutant PTEN that lacked four putative phosphorylation sites failed to rescue the chemotactic defects of cells lacking PTEN, and the mutant form also lacked lipid phosphatase activity when expressed with constitutively activated RhoA, suggesting that a RhoA-ROCK signaling pathway is required for phosphorylating and activating PTEN. Because neutrophils that were unable to activate Cdc42 in response to a chemoattractant also failed to localize RhoA and PTEN to the cell posterior, these two GTPase signaling pathways may cooperate to control PTEN during chemotaxis. — LDC

Nat. Cell Biol. 10.1038/ncb1236 (2005).

CREDITS: LI *ET AL.*, *NAT. CELL BIOL.* 10.1038/NCB1236 (2005)